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ABSTRACT

Two studies examined possible effects of four modes of infant care on child behavior exhibited later. Modes included care at home by the mother, at home by a relative or sitter, at a sitter's home, and in a group care center. First, a longitudinal study assessed children at 2 years of age on a wide array of personality and cognitive measures. A total of 115 children from the original sample were reassessed on the same dimensions at 4 years of age. Data were analyzed within the frameworks of two overlapping designs, which focused differentially on race of subjects and mode of care. A second, retrospective study of 122 black elementary school students 8 years of age investigated the relationship of six personality dimensions to the predominant mode of care experienced by subjects during the first 2 years of life. No significant statistical association was found after the effects of familial advantage and sex variables had been removed. Results of both studies suggested that the effects of various modes of infant care may become overshadowed by the effects of other, later experiences to the extent that, by the time the child is of school age, the effects are undetectable by ordinary methods. (RH)

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Infant Day Care: Effects at 2, 4, and 8 Years

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Today I am going to report on two studies, one longitudinal and one retrospective. Both examine the possible effects on later child behavior of three modes of infant care: care at home by the mother, care at a sitter's home, and care in a group center. Both studies were conducted in Bermuda where there is a long tradition of employment by mothers of very young infants and where institutions have existed for some time to meet these mother's needs. On an island with a total population of 55,000 people there are 10 infant-care centers that have been in operation for more than 5 years. There is no experimental day care on Bermuda. No child in the two studies was in an experimental day care program, nor was any child in a university-based day care program. This does not mean that the Government of Bermuda is uninterested in its children; on the contrary, it has generously supported our research and, in fact, instigated the project that led to these two studies.

To those of you who have never had the good fortune of visiting Bermuda, let me say that it is a country, actually a colony of Great Britain, with a standard of living comparable to that of the United States. Most residents own an automobile and a couple of TV sets. English is the native language and the only one spoken on the Island. The public school system is excellent and most Bermudians complete high school. The average Stanford-Binet IQ score of our representative sample of 115 four-year-olds was 105. The ratio of Blacks to other ethnic groups is about 60 to 40 and the society is more racially integrated than most major cities in the United States. With that background, I'll move on to the longitudinal study of children at 2 and 4 years of age.

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As part of a Government sponsored evaluation of Phyllis Levinstein's Verbal Interaction Project for its utility in Bermuda, between 1978 and 1980, 122 Bermudian children were first assessed at 2 years of age with a wide array of personality and cognitive measures (Ming, Note 1; Scarr, Note 2). Between 1980 and 1982, 115 children from the original sample were reassed at 4 years of age on the same dimensions. It is these longitudinal data that we examined as a function of the child's history of maternal and nonmaternal care. Several individuals participated with Sandra Scarr and myself in the design and administration of the pre- and posttest assessment batteries. These included most consistently Barbara Caparulo, David Furrow, Kathleen McCartney, Randy Billington, and Deborah Phillips, all graduate students then at Yale University. Carl Hindy of the University of Connecticut worked with me on the analyses I will present today.

At two years of age the assessment was conducted in the child's home and at four year years, at the Bermuda Child Development Center. An interviewer gathered data from the mother, while the examiner administered IQ and Delay of Gratification tests to the child. Both the interviewer and the examiner participated in administering the maternal teaching task, during which the child's cooperation with the mother was rated. Following the testing, the examiner completed the Bayley Infant Behavior Record and the Childhood Personality Inventory by Cohen and Dibble. The assessment battery was essentially the same at the age 4 follow-up, with the exception that the delay and maternal-teaching tasks were more difficult. Also, a test of concepts tailored to the Verbal Interaction Project was added. The variables scored from these assessment procedures are listed in Table 1.

Table 2 lists and describes a number of composites that were constructed from the variables in Table 1. Also listed are the intercorrelations among the variables in each composite, which consists of a sum of the listed variables

in standardized form, with appropriate reversals, as indicated.

In order to prevent possible demographic differences between children in different modes of care from contaminating our results, we created a single, highly reliable "Familial Advantage" score for each child to be used as a covariate. As shown in Table 2, it consisted of a standardized sum of the mother's WAIS vocabulary score, education, and occupational prestige, and the father's education and occupational prestige. The potential influence of ethnicity was also removed either by grouping or by covariation. The remaining composites were used as dependent variables in the analyses, together with I.Q., the delay-task score, and ratings by the examiner of deviancy, coordination, and cooperation with the mother. An exactly parallel set of composites was constructed from child behavior scores obtained at 4 years of age.

A detailed history of child care during the preceding two years was obtained from the mother at each assessment. The interviewer, beginning at the child's birth, inquired about every regular absence of the mother for employment or any other reason, and how the child was cared for in her absence. Care settings were further described in terms of the number of preschooler and caretakers in the face-to-face group. The average number of hours per week in each of three forms of nonmaternal care was calculated separately for each of the first four years of life. These three forms were care at home by a relative or sitter, care at a sitter's home, and care in a group care center. Maternal care at home by the mother became a fourth category when the other forms were excluded. The children in the sample were sorted into the four care modes on the basis of their predominant experience in the first two years of life, and again by their predominant experience in the second two years of life. Tables 3 and 4 show the results of this categorization for the respective periods.

Due to the very high rate of matneral employment in Bermuda among all ethnic groups, about 50% of infants were in regular nonmaternal care in the first year of life and about 80% in the second year. In the first two years of life, care at a sitter's home, typically with one or two other preschoolers present, is the most popular form of care. In the third and fourth years center group care is strongly favored. I'll be returning again to Table 3 later.

Now, if you look back at Table 3, under "Center Care, you may note that there were only two Caucasian children in Center Care during the first two years of life. To avoid misleading results from an overall analysis, the available data were analyzed in two overlapping designs. I refer to them as Model A and Model B. As illustrated in Table 3, Model A was used to examine child behavior as a function of the child's sex and just three of the four care modes; namely, Mother At Home, Other At Home, and At Sitter's Home. The Center Care Mode was deleted from Model A.

Model B, which was applied to the data of Black Bermudians only, afforded a comparison of children in Center Care with those in care At the Sitter's and in Care At Home. The latter category, At Home, was formed by combining the Mother-At-Home and Other-At-Home categories, since their respective numbers were relatively small and since the analysis of Model A for assessment data from 2 years of age revealed no differences between these two modes of infant care, as you will shortly see. Thus, Model B examines the effects of the child's sex and three modes of care--At Home, At Sitter's and At Center--on Black children only. It employes Familiar Advantage as a covariate.

Table 5 and 6 show the results for child behavior variables from the assessment at age 2. The present analysis employes the composites shown in Table 4, which were based, in part, on a factor analysis and are probably more

reliable than the constituent scores previously analyzed (Schwarz et al., Note 3). The statistical design for each model was a hierarchical multivariate analysis of covariance design, executed with the General Linear Model procedure of SAS. The results with Model A are presented in Table 5. The effects in the model were tested with a Type I error and are listed from left to right in order of introduction. Thus, the significance of the Sex effect was tested after the variance associated with Familial Advantage and Ethnicity had been removed, and the Care effect was tested after the effects of Familial Advantage, Ethnicity, and Sex had been removed from the dependent variable.

The most striking result from Model A, which includes both Ethnic Subgroups, is that the main effect of Care, which you see circled on Table 5 of your handout, was not, I repeat, not statistically reliable for any child behavior variable. This result indicates that for Bermudian children in general, there is no reliable relationship between these three modes of noncenter care and any of the child behaviors assessed. In other words, at 2 years of age, children with Mother At Home, children with a relative or sitter At Home, and children at the Sitter's home all look very much alike.

You will note that on two variables, IQ and Deviancy, there were significant Sex by Care interactions. Males in care by Mother At Home were lower in IQ and were rated higher in Deviancy by the testers, whereas females with Mother At Home were high in IQ and low in Deviancy

Model B gives us an opportunity to look at the correlates of Center Grou, care, relative to care at the Sitter's and Care at Home, while controlling for ethnicity via selection; only Black Bermudians were included in this analysis. In Table 6 we see several significant main effects for Care Mode, and the overall MANOVA statistic for Mode of Care is .08. If you'll turn to Table 9, as shown in the first column, children in Center care were generally less verbally expressive, and in the test situation were less active, and more

introverted or socially unresponsive than children in home care. Children in Center care were judged more deviant than those in Sitter care, and males in Sitter care were very low in deviancy. The double arrows indicate pairs of means that were significantly different by Duncan's multiple range test. The intelligence difference at two years is not significant when the effect of Familial Advantage is removed. Thus, children in center care at 2 years of age seem less verbally and socially responsive than children in home care.

To gain more information on the parameters of care that may be influencing child development, I undertook another analysis that included only those from both ethnic groups who were in any form of out-of-home care before age 2. Controlling statistically for Familiar Advantage and Ethnicity, these analyses showed that care conditions consisting of many hours per week in large groups and with many children per caretaker were associated with lower intelligence, poorer verbal expressiveness, and shorter attention span. These negative effects of group size and caretaker ratio on attention, verbal skill, and intelligence were especially marked in males and for care experience during the second year of life. Furthermore,children in out-of-home care who were rated as deviant at 2 years of age were predominantly those who had experienced care in large groups with unfavorable child-caretaker ratios. Thus, it appears that children who had been in group care, and especially those who had been in large groups with unfavorable child-caretaker ratios, were not doing very well.

Now, let's take a look at this same sample of children at 4 years of age. Table 7 summarizes the analysis of Model A for child behaviors at age four, and Table 8, for Model B. In both models, the variable entered next after sex is Mode-of-Care-in-the-first-two-years-of-life, and we can see that the overall MANOVA statistic at the bottom of the column does not approach significance. Focusing, for brevity's sake, on Model B in Table 8, what this means is that

the mode of care groups that were significantly different at 2 years of age are no longer significantly different at 4 years of age. In other words, the aprrarently negative effects of group care, observable at age two, had largely dissipated by age 4. Again, turning to Table 9, the relevant means may be found in column two under the label "four years" in the center of the table. You may note that the gap between the means of the Center Care and the Home Care groups had narrowed.

Turning back again to Table 8, note that, following Mode-of-Care 1-and-2 and its interaction with sex, Mode-of-Care-3-and-4 was next entered into the model, and it yielded significant effects for intelligence, activity level, and introversion. What this means is that, although the initial care experience was no longer correlated with child behavior, the more recent care experience, that occurring in the two years immediately preceding the follow-up, was correlated. If you will look again at Table 9, in the column on the far right under "Mode of Care third and fourth years, assessment age 4 years," you will find mean scores for children grouped according to their predominant mode of care in the third and fourth years. In contrast to the assessment at age 2, the group seeming to do less well at age 4 consists of those children who have been in sitter care for the last two years. Despite equal or superior familial advantage, this Sitter-Care Group was significantly less intelligent than the Home Care Group, and its children were significantly more introverted and less active than those in the Home Care Group. Males in sitter care are especially deviant. The Center Care Group also scored less favorably on intelligence than the home care group, despite equivalent familial advantage.

These data suggest that at 4 years of age the recent care experience is relatively more influential than the earlier care experience, and that sitter care as these children experienced it in the third and fourth years of life was a less than optimal care environment. I suspect that the programs in the group

care centers were sufficiently adequate that infants who may have incurred deficits in verbal and social responsiveness while in early group care were able to recoup those deificiencies during the third and fourth years of group care.

Now, I would like to make a brief preliminary report on selected variables from a second study, a retrospective study that Sandra Scarr and I are conducting on eight-year-olds from the Bermudian public school system. In order to maximize the congruence with the preceding study, today I will report on the relationship between the predominant mode of care in the first two years of life and current behavior at 8 years of age for a subset of 122 Black Bermudian children. In recruiting this sample a concerted effort was made to include children who had experienced <u>early</u> center-group care. As a result, 39% of the children experienced predominantly center care in the first two years; 39%, predominantly care at the sitter's home; and 21%, predominantly maternal care at home. These subgroups were equally divided by sex.

The early child care history, demographic, and social-behavioral reports about the child were obtained in a home interview, conducted, where possible, independently with both parents by a Bermudian college student. Included among the measures completed by parents was the Schaeffer Child Behavior Inventory. In school, the Schwarz-Alley Peer Description Form was completed for each child by an average of six peers. Scores on several social behavioral dimensions were obtained by averaging the ratings across the peer raters. Parent responses to scales of the Schaeffer CBI were also averaged. Then peer and parent scores on six dimensions held in common by the Peer Description Form and the Schaeffer Inventory were averaged to provide the most valid and generalizable ratings of these dimensions. The dimensions, Task Orientation, Distractability, Hostility, Considerateness, Introversion, and Extraversion, are listed on Table 10. It

may also be seen in Table 10 that Mode of Care from the first two years of life had no significant association with any one of these six personality dimensions, after the effect of Familial Advantage and Sex had been removed. Males with early sitter care tended to be more introverted than males with maternal care, and females; vice versa.

With regard to the California Achievement Test scores that were available on most children, children in early sitter care did significantly better on Math and tended to do better on Language as well, contrary to what one might expect from the assessment at 4 years of age from the VIP study.

In conclusion, both this retrospective study and the longitudinal follow-up of the VIP study suggest that the effects of various modes of infant care may become overshadowed by the effects of other later experiences to such an extent that they are either undetectable at school age or undetectable with ordinary methods of analysis, methods that do not include assessments of intervening experience. Nonetheless, it seems likely that individual children who have had a succession of unfavorable environments at each stage in development will show an accumulation of deficit. Our further analysis will pursue this possibility.

REFERENCE NOTES

Note 1: Ming, C. The child development project. Contribution to a symposium entitled "Government Promotes Child Development: The Case Study of Bermuda," Chaired by Kathleen McCartney at the Biennial Meeting of the Society for Research in Child Development. Detroit, MI, April, 1983.

Note 2: Scarr, S. Evaluation research can be relevant to policy decisions. Contribution to a symposium entitled "Government Promotes Child Development: The Case Study of Bermuda," Chaired by Kathleen McCartney at the Biennial Meeting of the Society for Research in Child Development. Detroit, MI, April, 1983.

Note 3: Schwarz, J. C., Scarr, S. W., Caparulo, B., Furrow, D., McCartney, K., Billington, R., Phillips, D., Hindy, C. Center, sitter, and home day care before age two: A report on the first Bermuda infant care study. Contribution to symposium entitled "Infant day care: Short- and long-term evaluations," chaired by J. Conrad Schwarz at the American Psychological Association Annual Convention in Los Angeles, August, 1981.

Table 1

Variables Assessed in the Bermuda Infant Day-Care Study

Variables	Source of Data: mother's behavior	child's behavior	mother's report	tester's reports
Family Background (Control) Variables				
Mother's WAIS vocabulary	x			
Mother's ethnicity				x
Mother's extent of employment			x	
Mother's education			x	
Father's education			x	
Child Behavior Variables				
Childhood Personality Scale (Cohen & Dibble)				
Introversion			x	x
Apathy			x	x
Verbal Expressiveness			x	x
Attention Span			x	x
Hyperactivity			x	x
Infant Behavior Record (Bayley)				
Active Factor				x
Attention Factor				x
Social Responsiveness Factor				x
Cain-Levine Social Competency Scale				
Communicative competency			x	
Adaptive Skills			x	
Deviancy rating (Bayley, IBR)				x
Coordination rating (Bayley, IBR)				x
Maternal teaching task				
Child's attitude				x
Mother-child interaction				x
Delay of gratification				
Wait-on-Request (Age 2)		x		
Wait-to-Accumulate (Age 4)		x		
Stanford-Binet and/or Bayley IQ score		x		
Tailored Concepts Test (Age 4)		x		

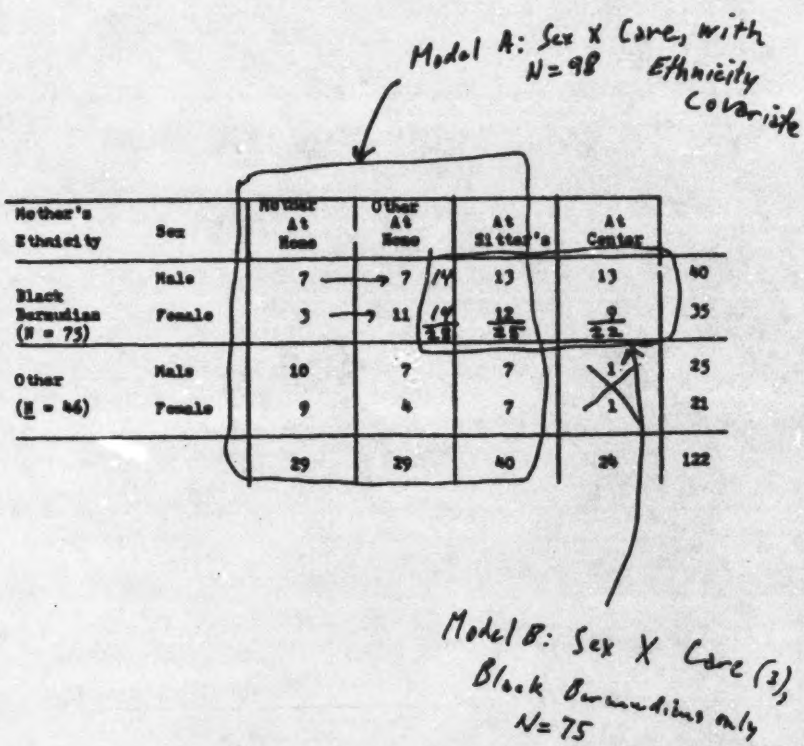
Table 2

Formation of Composite Variables

COMPOSITE VARIABLES		M.E.	F.Ed.	M.Occ.	F.Occup.
Familial Advantage	Mother's WAIS Vocabulary	.58	.47	.58	.33
	Mother's Education		.36	.57	.31
	Father's Education			.31	.47
	Mother's Occup. Prestige				.30
	Father's Occup. Prestige				
				ApaT	ActT
Activity Level during Testing	Hyperactivity CPS Yale Tester			.68	.68
	Apathetic CPS Yale Tester (Rev.)				.41
	Active IBR Yale Tester				
				ApaT	IBRT
Introversion during Testing	Introversion CPS Yale Tester			.70	.74
	Apathetic CPS Yale Tester				.62
	Social Resp. IBR Yale Tester (Rev.)				
				AttTC	AttTI
Attention Span	Attention CPS Mother			.22	.21
	Attention CPS Yale Tester				.73
	Attention IBR Yale Tester				
				ApaM	ExpM
Introversion in Mother's View	Introversion CPS Mother			.41	.38
	Apathetic CPS Mother				.23
	Expressive CPS Mother (Rev.)				
				ExpM	ExpT
Verbal Expressiveness	Comm. Competency Cain-Levine			.46	.46
	Expressive CPS Mother				.12
	Expressive CPS Yale Tester				

Table 3

Numbers of Subjects in each CareMode At Years One and Two by Sex and Ethnicity



Mother's Ethnicity	Sex	Mother At Home	Other At Home	At Sitter's	At Center	
Black Bermudian (N = 75)	Male	7 → 7	14	13	13	40
	Female	3 → 11	14	12	9	35
			28	25	22	
Other (N = 46)	Male	10	7	7	1	25
	Female	9	4	7	1	21
		29	29	40	24	122

Table 4

Numbers of Subjects in each Care Mode At Years 3 & 4 by Sex and Ethnicity

		Care Mode 3 & 4				
Mother's Ethnicity	Sex	Mother At Home	Other At Home	At Sitter's	At Center	
Black Bermudian (N=73)	Male	4	2	9	25	40
	Female	7	3	7	16	33
Other (N=40)	Male	5	0	2	15	22
	Female	7	1	5	5	18
		23	6	23	61	113

Table 5

Model A (Black Bermudians and Other Subjects; Center Care Deleted; N = 98): Significant Effects on Child Behavior at Age Two from a Hierarchical Multivariate Analysis of Covariance (MANCOVA) Design— Sex by Care Mode, with Familial Advantage and Ethnicity as Covariates (Mother At Home, N=29; Other At Home, N=29; At Sitter's, N=40)

Child Behavior at Age Two	Significance of Effects					Sign. of Model	
	Fam Advan	Ethn	Sex	(Care)	Sex * Care	R	R^2
I. Q.	.0001		.01		.05	.0001	.47
Delay Task	.005		.009			.02	.17
Deviancy	.01				.05	.02	.17
Coordination							.05
Coop. w/ Mother	.004		.01			.02	.17
Vbl. Expressiveness	.004	.03	.04			.01	.18
Attention Span							.08
Hyperactivity: Mother	.004	.05	.04			.008	.19
Hyperactivity: Tester							.06
Introversion: Mother							.05
Introversion: Tester	.02					.10	.12
MANOVA Wilk's Lambda	.0001	.07	.23	(.78)	.61		

Table 6

Model B (Black Bermudians Only; Center Care Included; N = 75): Significant Effects on Child Behavior at Age Two from a Hierarchical Multivariate Analysis of Covariance (MANCOVA) Design—Sex by Care Mode, with Familial Advantage as the Covariate

Child Behavior at Age Two	Significance of Effects				Sign. of Model	
	Fam Advan	Sex	(Care)	Sex * Care	R	R^2
I. Q.	.0001	.004			.0001	.36
Delay Task	.02					.12
Deviancy	.09		.009	.05	.006	.23
Coordination		.05				.13
Coop. w/ Mother						.09
Vbl. Expressiveness	.01	.01	.002		.0007	.28
Attention Span		.04				.11
Hyperactivity: Mother						.10
Hyperactivity: Tester			.04		.08	.15
Introversion: Mother		.03				.12
Introversion: Tester			.03		.06	.16
MANOVA Wilk's Lambda	.0005	.18	(.08)	.11		

TABLE 7

Model A at Age Four (Black and Other Bermudians; Children in Center Care at Age Two Excluded): Significant Effects on Child Behavior from a Hierarchical Multivariate Analysis of Covariance (MANCOVA) Design— Sex by Care Mode in Years One and Two by Care Mode in Years Three and Four, with Familial Advantage and Ethnicity as Covariates (Total N = 88)

Child Behavior at Age Four	Significance of Effects									Sign of Model	
	Fam Advan	Ethn	Sex	Mode of Care 1 & 2	Sex • Care	Mode of Care 3 & 4	Sex • Mode 3,4	Mode 1,2 • Mode 3,4	Sex • Mode 1,2 • Mode 3,4	P	R^2
I. Q.	.0001		.0001			.03			.05	.0001	.65
Concept Test	.0001		.01		.03					.0001	.55
Delay Task							.02	.08		.04	.38
Deviancy	.01	.04	.01	.03	.03		.002			.0007	.50
Coordination											.17
Coop w/ Mother	.0005		.002							.09	.35
Vbl. Expressiveness	.0001									.01	.42
Attention Span	.003		.04				.04			.06	.37
Hyperactivity: Mother	.003	.04	.0008			.10				.02	.41
Hyperactivity: Teacher											.26
Introversion: Mother	.009						.04			.08	.35
Introversion: Teacher	.09					.08					.29
MANOVA Wilk's Lambda	.0001	.08	.02	.68	.36	.36	.02	.57	.47		

Table 8

Model B At Age Four (Black Bermudians only; All Center Care Children Included): Significant Effects on Child Behavior from a Hierarchical Multivariate Analysis of Covariance (MANCOVA) Design— Sex by Care Mode in Years One and Two by Care Mode in Years Three and Four, with Familial Advantage as the Covariate (Total N = 71)

Child Behavior at Age Four	Significance of Effects								Sign of Model	
	Fam Advan	Sex	Mode of Care 1 & 2	Sex • Care	Mode of Care 3 & 4	Sex • Mode 3,4	Mode 1,2 • Mode 3,4	Sex • Mode 1,2 • Mode 3,4	P	R^2
I. Q.	.0001	.0003		.07	.0008	.07		.10	.0001	.63
Concept Test	.0004	.05							.02	.38
Delay Task	.04					.07				.27
Deviancy		.09				.004	.06		.01	.39
Coordination							.01			.27
Coop w/ Mother	.03	.07								.26
Vbl. Expressiveness	.001								.06	.34
Attention Span	.0001					.02		.08	.002	.46
Hyperactivity: Mother		.02					.07			.27
Hyperactivity: Teacher					.03					.30
Introversion: Mother	.006									.26
Introversion: Teacher					.02				.02	.27
MANOVA Wilk's Lambda	.0001	.11	.08	.42	.06	.23	.13	.32		

Table 9

T-score Means for Mode Care Subgroups from Model B.

Care Mode in First and Second Years	Assessment Age: Two Yrs. N	Two Yrs. M	Four Yrs. N	Four Yrs. M	Care Mode in Third and Fourth Years	Assessment Age: Four Yrs. N	Four Yrs. M
Familial Advantage							
Home	(28)	46.2	(27)	45.8	Home	(15)	46.3
Sitter	(25)	49.5	(24)	49.1	Sitter	(16)	47.9
Center	(22)	46.2	(21)	46.2	Center	(41)	47.0
Intelligence (S-B IQ)							
Home		47.2		48.6	Home		53.2
Sitter		49.2		47.8	Sitter		44.0
Center		44.3		45.4	Center		46.6
Verbal Expressiveness							
Home		53.4		48.2	Home		50.5
Sitter		51.3		50.8	Sitter		49.8
Center		43.6		45.0	Center		46.6
Hyperactivity: Tester							
Home		53.7		49.1	Home		52.1
Sitter		49.1		49.5	Sitter		44.9
Center		46.8		50.5	Center		50.6
Introversion: Tester							
Home		47.1		50.5	Home		45.9
Sitter		51.1		51.7	Sitter		55.7
Center		55.2		51.3	Center		51.3
Deviancy Rating: Tester							
Home		50.9		46.3	Home		47.8
Sitter		46.2		50.7	Sitter		51.3
Center		55.6		49.9	Center		48.3

Table 10

A Retrospective Study of Infant Day Care at Age Eight: Significance of Effects on the Behavior of Black Bermudian Children from a Hierarchical Multivariate Analysis of Covariance (MANCOVA) Design-- Sex by Care Mode During Years One and Two, with Familial Advantage as a Covariate

Child Behavior Eight-year-olds	Significance of Effects				Sign. of Model	
	Fam Advan	Sex	Care	Sex * Care	p	R^2
Average of Peer and Parent Ratings (N=127)						
Task Orientation	.17	.0009			.02	.13
Distractability	.07	.001			.03	.11
Hostility	.003	.06			.04	.11
Introversion	.006			.09	.05	.10
Extraversion	.09	.01			.02	.12
Consideration	.004	.001			.002	.17
MANOVA Wilk's Lambda	.03	.007	.75	.62		
California Achievement Test (N=93)						
Language			.10			.09
Math	.07		.004		.01	.17
Reading	.02					.11
MANOVA Wilk's Lambda	.11	.98	.09	.37		